



IEEE IPCCC 2003

<http://www.ipccc.org/>

22ND IEEE INTERNATIONAL PERFORMANCE, COMPUTING, AND COMMUNICATIONS CONFERENCE

ADVANCE PROGRAM

EMBASSY SUITES PHOENIX NORTH
PHOENIX, ARIZONA, U.S.A.
APRIL 9-11, 2003



IEEE
COMPUTER
SOCIETY



IEEE
COMMUNICATIONS
SOCIETY



IEEE COMPUTER SOCIETY
TECHNICAL COMMITTEE
ON THE INTERNET

IPCCC 2003
GENERAL CHAIRS' MESSAGE

Welcome to the 2003 IEEE International Performance, Computing and Communications Conference (IPCCC 2003). This is the 22nd year that IPCCC has brought together researchers and practitioners in the fields of performance, computers, and communications for lively and productive discussions. We are grateful for the continuing sponsorship by the IEEE Computer Society and the IEEE Communications Society that supports this forum.

The keynote speakers will challenge us to consider new issues in our rapidly converging fields, ranging from gauging the performance of gargantuan networks of computers to applying computing to solve the challenges of wireless networks.

This year's technical tracks offer a selection of rigorously refereed papers presented in 14 sessions, plus two workshop tracks addressing cutting-edge research in Energy-Efficient Wireless Networks and End-to-End Service Differentiation. The program committees for these tracks received many more high-quality papers than we could accept: 100 papers were submitted for the general tracks, of which we accepted 36 as full papers and 10 more as short papers; only half of the papers submitted for the workshops were accepted. The technical tracks also include three panel sessions that we hope will stimulate discussion of new ideas in sensor networks, freedom versus security on the Internet, and realizing the dream of ubiquitous multi-platform programming.

The technical program is preceded by a day of tutorial sessions that will provide the latest information on topics of current interest, taught by global experts from industry and academia. Tutorials competing for your interest span the broad range of topics covered by this conference, including IP-Oriented QoS in Next Generation Networks, Wireless Sensor Network Protocols, Network Awareness for Heterogeneous Data Networks, Pervasive Computing, Java Database Applications and Security, E-commerce and Java Cryptography, and Application Scalability.

The organization of this conference is the fruit of long hours of volunteer work by the program and executive committees. I extend my thanks to the committee members and paper referees whose diligent work has ensured the quality of IPCCC 2003. It is a rare privilege to work with such talented and dedicated professionals.

The setting for the conference is the beautiful Embassy Suites Phoenix North Resort. We hope you enjoy the renowned climate and natural beauty of the Valley of the Sun, and invite you to extend your stay to go on one of the tours of scenic and historical Arizona that we have arranged for your convenience. Welcome to Phoenix, and thank you for your support of IPCCC.

ERIC JOHNSON
GENERAL CHAIR, IPCCC 2003

IPCCC 2003
KEYNOTE SPEAKERS

THURSDAY, APRIL 10, 8:00 A.M. - 9:00 A.M.

NEIL J. GUNTHER

"GAUGING GARGANTUAN COMPUTERS: BENCHMARKING PRATS AND PITFALLS"

In 1987 a paper appeared in IEEE Spectrum entitled "Computer Benchmarking: Paths and Pitfalls." The complexity of computer systems has increased exponentially since 1987, principally through the advent of distributed applications. Has benchmarking kept up? Today we are entering the era of tera-, or is it terra(?)-, or is it really terror(?) scale distributed computing. One of the best working examples is SETI@Home where relatively tiny workloads are partitioned across a gargantuan number of FLOPs in the guise of desktop CPUs. The so-called "Computing GRID" has the goal of extending a similar approach to more complex computers running more complex workloads. How are we to assess the performance and scalability of such large systems? What sort of benchmarks are appropriate for these emerging computer technologies?

Arguably, benchmarking is a form of institutionalized cheating. Nonetheless there is a genuine need to measure system performance in both development procurement cycles, and it behooves us to understand the prats and pitfalls of benchmarking large-scale computer systems already in existence.

FRIDAY, APRIL 11, 8:00 A.M. - 9:00 A.M.

C-K TOH

"RESEARCH CHALLENGES FOR AD HOC MOBILE WIRELESS NETWORKS"

Increasingly, we have seen many research papers published in the area of ad hoc wireless networking. Over a decade, research in this field is still striving but few knew HOW or WHY it evolves, not to mention about its FUTURE. This technology is also playing an important role in defense and academia. The former enhances war-fighting capability, be it ground, sea, or air. The latter, however, produces quite a few PhDs! This talk will present the ad hoc research momentum wheel (from the perspective of 10 years' experience), a brief preview of current research and a vision of future research challenges for ad hoc wireless networks: ad hoc naming and addressing; mobile power management; high capacity ad hoc communications; ad hoc packet forwarding models and incentives; ad hoc route precedence and pre-emptions; ad hoc service discovery; ad hoc distributed computing; and other exhausting issues (security, QoS, multimedia, spectrum, etc.). The talk will conclude with a discussion of the factors that govern the future success of ad hoc technology and the research lifespans that remains.

**IPCCC 2003
EXECUTIVE COMMITTEE**

GENERAL CHAIR
ERIC JOHNSON
NEW MEXICO STATE
UNIVERSITY
ejohnson@nmsu.edu

GENERAL VICE CHAIRS
DARRELL D.E. LONG
UNIVERSITY OF CALIFORNIA,
SANTA CRUZ
darrell@cs.ucsc.edu

LINDA F. WILSON
DARTMOUTH COLLEGE
Linda.F.Wilson@dartmouth.edu

PROGRAM CHAIRS
ALAN D. GEORGE
UNIVERSITY OF FLORIDA
george@hcs.ufl.edu

GUOLIANG (LARRY) XUE
ARIZONA STATE UNIVERSITY
xue@asu.edu

WORKSHOP CHAIR
HOSSAM HASSANEIN
QUEEN'S UNIVERSITY
hossam@cs.queensu.ca

TUTORIAL CHAIR
MOHSEN GUIZANI
UNIVERSITY OF WEST
FLORIDA
mguizani@cs.uwf.edu

PANELS CHAIR
RICHARD OLIVER
NEW MEXICO STATE
UNIVERSITY
roliver@nmsu.edu

PUBLICATIONS CHAIR
GOLDEN G. RICHARD III
UNIVERSITY OF NEW
ORLEANS
golden@cs.uno.edu

FINANCE CHAIRS
NASR ULLAH
MOTOROLA INC.
Nasr.Ullah@motorola.com

JACK CHEN
MOTOROLA INC.
Jack.Chen@motorola.com

REGISTRATION CHAIR
BRIAN GRAYSON
MOTOROLA INC.
Brian.Grayson@motorola.com

IEEE LIASON
PATRICIA TELLER
UNIVERSITY OF TEXAS AT
EL PASO
pteller@cs.utep.edu

FAR-EAST LIASONS
JOGESH MUPPALA
HONG KONG UNIVERSITY OF
SCIENCE AND TECHNOLOGY
muppala@cs.ust.hk

HEE YONG YOUN
SUNGKYUNKWAN UNIVERSITY
youn@ece.skku.ac.kr

EUROPEAN LIASONS
HORST CLAUSEN
UNIVERSITY OF SALZBURG
clausen@cosy.sbg.ac.at

OTTO KOUDELKA
TECHNICAL UNIVERSITY OF
GRAZ
okoudelka@compuserve.com

WEBMASTER
NEIL K. NELSON
MOTOROLA, INC.
Neil.Nelson@motorola.com

**IPCCC 2003
TECHNICAL PROGRAM COMMITTEE**

DHARMA AGRAWAL,
UNIVERSITY OF CINCINNATI

IAN AKYLIDIZ,
GEORGIA TECH

HASAN CAM,
ARIZONA STATE UNIVERSITY

MATTHEW CHIDESTER,
INTEL CORPORATION

KEN CHRISTENSEN,
UNIVERSITY OF SOUTH FLORIDA

HORST CLAUSEN,
UNIVERSITY OF SALZBURG

SAJAL DAS,
UNIVERSITY OF TEXAS, ARLINGTON

JACK DONGARRA,
UNIVERSITY OF TENNESSEE

DINGZHU DU,
UNIVERSITY OF MINNESOTA

MICHAEL FANG,
UNIVERSITY OF FLORIDA

MOHSEN GUIZANI,
UNIVERSITY OF WEST FLORIDA

MOUNIR HAMD, I,
HKUST

SALIM HARIRI,
UNIVERSITY OF ARIZONA

HOSSAM HASSANEIN,
QUEEN'S UNIVERSITY

PATRICIA HOUGH,
SANDIA NATIONAL LABS

XIAOJUA JIA,
CITY UNIVERSITY OF HONG KONG

KEONWOOK "KEN" KIM,
FLORIDA STATE UNIVERSITY

MARWAN KRUNZ,
UNIVERSITY OF ARIZONA

SOO-YOUNG LEE,
AUBURN UNIVERSITY

YI-BING LIN,
NATIONAL JIAOTONG UNIVERSITY

ARTHUR MACCABE,
UNIVERSITY OF NEW MEXICO

HUSSEIN MOUFTAH,
UNIVERSITY OF OTTOWA

JOGESH MUPPALA,
HKUST

LIONEL NI,
MICHIGAN STATE UNIVERSITY

IOANIS NIKOLAIDIS,
UNIVERSITY OF ALBERTA

MOHAMMAD S. OBADAT,
MONMOUTH UNIVERSITY

J.F. PARIS,
UNIVERSITY OF HOUSTON

V. PRASANNA,
USC

NAGI S.V. RAO,
OAK RIDGE NATIONAL LABS

MUSHTAQ SARWAR,
APPLE CORPORATION

ARUN K. SOMANI,
IO
WA STATE UNIVERSITY
K. THULASIRAMAN,
UNIVERSITY OF OKLAHOMA

W.T. TSAI,
ARIZONA STATE UNIVERSITY

SHUN YAO,
UNIVERSITY OF CALIFORNIA DAVIS

ALEC YASINSAC,
FLORIDA STATE UNIVERSITY

**GROUP TOURS FOR IPCCC
BY SOUTHWEST CUSTOM TOURS**

Tours will be conducted by Southwest Custom Tours on Saturday, April 12. The first is a Grand Canyon excursion which costs \$84.00 per person. The second is a Sedona Tour at \$47.00. The third is a Tombstone tour for \$69.00. To sign up for a tour, contact Southwest Tours at (800)513-1381 or go to: www.southwesttours.com. When registering for a tour, mention IPCCC to ensure the correct discounted price. For more information, check with THE IPCCC 2003 registration desk.

IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT SOUTHWEST CUSTOM TOURS.
TOLL-FREE, 24 HOUR RESERVATION AND INFORMATION LINE: (800) 513-1381
FAX: (602) 992-5596
E-MAIL INFO@SOUTHWESTTOURS.COM
[HTTP://WWW.SOUTHWESTTOURS.COM/](http://WWW.SOUTHWESTTOURS.COM/)

TECHNICAL PROGRAM SCHEDULE, THURSDAY, APRIL 10, 2003

KEYNOTE SPEAKER: 8:00 - 9:00 A.M. – NEIL J. GUNTHER; “GAUGING GARGANTUAN COMPUTERS: BENCHMARKING PRATS AND PITFALLS”

SESSION 1: 9:15 - 10:30

SESSION 1.1: PERFORMANCE EVALUATION I

1.1.1 IMPACT OF REQUEST ROUTING ALGORITHMS ON THE DELIVERY PERFORMANCE OF CONTENT DELIVERY NETWORKS
Mirco Masa and Emanuele Parravicini, CEFRIEL/Politecnico di Milano

1.1.2 PERFORMANCE EVALUATION FOR PENALTY-BASED RESOURCE MANAGEMENT: AN ADAPTIVE QoS SCHEME FOR SERVICE DIFFERENTIATION AND ADAPTATION IN HETEROGENEOUS WIRELESS NETWORKS
Chi-Hsiang Yeh, Queen's University

1.1.3 A NOVEL ARCHITECTURE AND COEXISTENCE METHOD TO PROVIDE GLOBAL ACCESS TO/FROM BLUETOOTH WPANS BY IEEE 802.11 WLANs
Carlos Cordeiro, Sachin Abhyankar, Rishi Toshiwal, and Dharma P. Agrawal, University of Cincinnati

SESSION 1.2: MULTICAST ROUTING

1.2.1 GROUP AGGREGATION FOR SCALABLE ANYCAST ROUTING
Zhibin Mai, Shengquan Wang, Dong Xuan, and Wei Zhao, Texas A&M University

1.2.2 TMRCC: A CONGESTION CONTROL MECHANISM FOR TREE-BASED MANY-TO-MANY RELIABLE MULTICAST PROTOCOLS
Je-young Yu, Kyungran Kang, and Dongman Lee, Information and Communications University, Korea; and Hee Yong Youn, Sungkyunkwan University, Korea

1.2.3 BOTTOM-UP CONSTRUCTION OF DYNAMIC MULTICAST TREES IN WDM NETWORKS
Guoliang Xue and Rakesh Banka, Arizona State University

SESSION 1.3: NO SESSION

BREAK: 10:30 - 10:45

SESSION 2: 10:45 - 12:00

SESSION 2.1: HIGH-PERFORMANCE COMPUTING

2.1.1 AUTONOMIA: AN AUTONOMIC COMPUTING ENVIRONMENT
Xiangdong Dong, Salim Hariri, Lizhi Xue, Huoping Chen, Ming Zhang, Sathija Pavuluri, and Soujanya Rao, University of Arizona

2.1.2 PERFORMANCE ANALYSIS OF HP ALPHASERVER ES80 vs. SAN-BASED CLUSTERS
Burt Gordon, Sarp Oral, Gen Li, Hung-Hsun Su, and Alan George, University of Florida

2.1.3 HIGH-PERFORMANCE EMBEDDED COMPUTING FOR CONVENTIONAL MATCHED-FIELD PROCESSING
Keonwook Kim, Florida A&M University and Florida State University; and Alan George, University of Florida

SESSION 2.2: MOBILE AD-HOC NETWORKS

2.2.1 ENERGY-EFFICIENT BROADCAST AND MULTICAST ROUTING IN AD HOC WIRELESS NETWORKS
Maggie Cheng, Jianhua Sun, Manki Min, and Ding-Zhu Du, University of Minnesota

2.2.2 ACHIEVING FAIRNESS IN DISTRIBUTED SCHEDULING IN WIRELESS AD-HOC NETWORKS
Arun Somani and Jianwei Zhao, Iowa State University

2.2.3 FAIR SCHEDULING IN WIRELESS AD-HOC NETWORKS OF LOCATION DEPENDENT CHANNEL ERRORS
Jinran Chen and Arun Somani, Iowa State University

SESSION 2.3: EWCN – VIRTUAL BACKBONES AND CROSS-LAYER DESIGNS

2.3.1 Ad Hoc Grids: Communication and Computing in a Power Constrained Environment
Dan Marinescu, Gabriela Marinescu, Yongchang Ji, and Ladislau Boloni, University of Central Florida

2.3.2 OPTIMAL CROSS-LAYER DESIGNS FOR ENERGY-EFFICIENT WIRELESS Ad Hoc and Sensor Networks
Ahmed Safwat, Hossam Hassanein and Hussein Mouftah, Queen's University

2.3.3 POWER-EFFICIENCY CLUSTERING METHOD WITH POWER-LIMIT CONSTRAINT FOR SENSOR NETWORKS
Jain-Shing Liu, Providence University, and Chun-Hung Lin, National Sun Yat-Sen University

LUNCH: 12:00 - 1:15

SESSION 3: 1:15 - 2:30

SESSION 3.1: PERFORMANCE EVALUATION II

3.1.1 ADJUSTABLE MULTI-CONSTRAINED ROUTING WITH A NOVEL EVALUATION METHOD
Yong Cui, Ke Xu, and Jianping Wu, Tsinghua University

3.1.2 A QoS ENABLED MAC PROTOCOL FOR MULTI-HOP Ad Hoc WIRELESS NETWORKS
Zhou Ying, A.L. Ananda, and Lillykutty Jacob, National University of Singapore

3.1.3 MINIMAL CONNECTED DOMINATING SET ALGORITHMS AND APPLICATION FOR A MANET ROUTING PROTOCOL
Tao Lin, Scott Midkiff, and Jahng Park, Virginia Polytechnic Institute and State University

SESSION 3.2: NETWORK SECURITY

3.2.1 IDENTIFYING FLAWS IN THE SECURE ROUTING PROTOCOL
John Marshall, Vikram Thakur, and Alec Yasinsac, Florida State University

3.2.2 AN IMPROVEMENT ON SECURE COMMUNICATIONS IN PCS
Nawal El-Fishawy, Mostafa Nofal, and Albert Tadros, Faculty of Electronic Engineering, Menouf, Egypt

3.2.3 HIGH-SPEED ROUTER FILTER FOR BLOCKING TCP FLOODING UNDER DDoS ATTACK
Yoochwan Kim and Ju-Yeon Jo, Case Western Reserve University; Jonathan Chao, Polytechnic University; and Frank Merat, Case Western Reserve University

SESSION 3.3: EWCN – PERFORMANCE IMPROVEMENT FOR ENERGY-EFFICIENT COMMUNICATIONS

3.3.1 AN ENERGY-EFFICIENT TCP QUICK TIMEOUT SCHEME FOR WIRELESS LANs
Song Ci, Stephen Turner and Hamid Sharif, University of Michigan-Flint

3.3.2 ADAPTIVE MANAGEMENT OF BLUETOOTH MASTER/SLAVE BRIDGE
Jelena Mistic and Vojislav B. Mistic, The Hong Kong University of Science and Technology

3.3.3 A SIMPLIFIED AND EFFICIENT IMPLEMENTATION OF FPGA-BASED TURBO DECODERS
Sanjay Sharma, Sanjay Attri, and R.C. Chauhan, SLIET

BREAK: 2:30 - 2:45

SESSION 4: 2:45 - 4:00

SESSION 4.1: PERFORMANCE EVALUATION III

4.1.1 A FRAMEWORK FOR DYNAMIC SLA MANAGEMENT UNDER HETEROGENEOUS TRAFFIC CONDITIONS IN MPLS NETWORKS
Brikena Statovci-Halimi, Artan Halimi, Karl Hendling, and Harmen van As, Vienna University of Technology

4.1.2 REDUCING LOAD DISTRIBUTION OVERHEAD WITH MESSAGE AGGREGATION
Vasil Hnatyshin and Adarshpal Sethi, University of Delaware

4.1.3 A CLIENT SIDE MEASUREMENT SCHEME FOR REQUEST ROUTING IN VIRTUAL CONTENT DELIVERY NETWORKS
Rami Mukhtar and Zvi Rosberg, University of Melbourne

SESSION 4.2: SURVIVABLE NETWORKS AND TRAFFIC

4.2.1 LONG-TERM DATA RESILIENCE USING OPINION POLLS
Nikolaos Michalakis, Dah-Ming Chiu, and David Rosenthal, Sun Microsystems Laboratories

4.2.2 HARTS: HIGH AVAILABILITY CLUSTER ARCHITECTURE WITH REDUNDANT TCP STACKS
Zhiyuan Shao, Hai Jin, Bin Chen, Jie Xu, and Jianhui Yue, Huazhong University of Science and Technology

4.2.3 NETWORK ANALYSIS OF COUNTER-STRIKE AND STARCRAFT
Mark Claypool, David LaPoint, and Josh Winslow, Worcester Polytechnic University

SESSION 4.3: EWCN – ROUTING IN WIRELESS MULTI-HOP NETWORKS

4.3.1 MINIMUM-ENERGY BROADCAST ROUTING IN WIRELESS MULTI-HOP NETWORKS
Song Guo and Oliver Yang, University of Ottawa

4.3.2 ANT ROUTING ALGORITHM FOR MOBILE Ad Hoc NETWORKS (ARAMA)
Osama Hussein and Tarek Saadawi, City University of New York

4.3.3 A COMPARATIVE STUDY OF ON-DEMAND AND CLUSTER-BASED ROUTING PROTOCOLS IN MANETS
Tarek Sheltami and Hussein Mouftah, Queen's University

BREAK: 4:00 - 4:15

PANEL 1: 4:15 - 5:30

SENSOR NETWORKS; THE CROSS-DISCIPLINARY RESEARCH CHALLENGE

PANEL CHAIR: KARAM S. CHATHA

IPCCC RECEPTION; 6:00 P.M. - 8:00 P.M.

TECHNICAL PROGRAM SCHEDULE, FRIDAY, APRIL 11, 2003

KEYNOTE SPEAKER: 8:00 - 9:00 A.M. - C-K TOH; "RESEARCH CHALLENGES FOR AD HOC MOBILE WIRELESS NETWORKS"

SESSION 5: 9:15 - 10:30

SESSION 5.1: NETWORK PROTOCOLS I

5.1.1 ON THE ADVANTAGES OF LIFETIME AND RTT CLASSIFICATION SCHEMES FOR TCP FLOWS
Xudong Wu and Ioanis Nikolaidis, University of Alberta

5.1.2 TCP VEGAS-A: SOLVING THE FAIRNESS AND REROUTING ISSUES OF TCP VEGAS
Srijith Krishnan Nair, Jacob Lillykutty, and A.L. Ananda, National University of Singapore

5.1.3 A NOVEL FAIR BANDWIDTH ALLOCATION ALGORITHM FOR TCP WINDOW CONTROL
Fei Peng and Victor Leung, University of British Columbia

SESSION 5.2: EMBEDDED SYSTEMS

5.2.1 A UNIFIED, LOW-OVERHEAD FRAMEWORK TO SUPPORT CONTINUOUS PROFILING AND OPTIMIZATION
Ming Zhang, University of Rhode Island; Xubin He, Tennessee Technological University; and Qing Yang, University of Rhode Island

5.2.2 SCENARIO-BASED TEST CASE GENERATION FOR STATE-BASED EMBEDDED SYSTEMS
W. Tsai, L. Yu, X. Liu, A. Saimi, Y. Xiao, Arizona State University

5.2.3 THE POTENTIAL OF COMPRESSION TO IMPROVE MEMORY SYSTEM PERFORMANCE, POWER CONSUMPTION, AND COST
Nihar Mahapatra, Jiangjiang Liu, and Krishnan Sundaresan, University of Buffalo; Srinivas Dangeti and Balakrishna Venkatrao, Sun Microsystems

SESSION 5.3: EESD-MODELING AND SIMULATION

5.3.1 ACTIVE QUEUE MANAGEMENT AND GLOBAL FAIRNESS OBJECTIVES
Xudong Wu and Ioanis Nikolaidis, University of Alberta

5.3.2 MULTI-OBJECTIVE OPTIMIZATION BASED FLOW CONTROLLING MULTIPOINT-TO-POINT COMMUNICATION
Hossam Hassanein, Xinhua Weng and Hosam Aboelfotoh, Queen's University

5.3.3 A PERFORMANCE ANALYSIS OF A REFINED HYBRID TDMA/CDMA PROTOCOL FOR WIRELESS NETWORKS WITH A QoS ADAPTATION
A. Boukerche and T. Dash, University of North of Texas

BREAK: 10:30 - 10:45

SESSION 6: 10:45 - 12:00

SESSION 6.1: NETWORK PROTOCOLS II

6.1.1 TRANSPARENT DISTRIBUTED WEB CACHING WITH MINIMUM EXPECTED RESPONSE TIME
Qing Zou, Patrick Martin and Hossam Hassanein, Queen's University

6.1.2 ALGORITHMS FOR EFFECTIVE VARIABLE BIT RATE TRAFFIC SMOOTHING
Zonghua Gu and Kang Shin, University of Michigan

6.1.3 RATE-CONTROLLED SCHEDULING FOR NETWORKED MULTIMEDIA APPLICATIONS
Fan Zhang and Samuel Chanson, Hong Kong University of Science and Technology

SESSION 6.2: STORAGE SYSTEMS

6.2.1 PERFORMANCE MODELING OF A DISK SUBSYSTEM AND ITS APPLICATION TO PERFORMANCE DESIGN OF A WEB PROXY SERVER
Atsuhiko Tanaka, Masahiko Takahashi, and Kosuke Tatsukawa, NEC Corporation

6.2.2 VISUALIZING CACHE EFFECTS ON I/O WORKLOAD PREDICTABILITY
Ahmed Amer, University of Pittsburgh; Alison Luo, Newton Der, Darrell Long, and Alex Pang, University of California, Santa Cruz

6.2.3 A PROACTIVE IMPLEMENTATION OF INTERACTIVE VIDEO-ON-DEMAND
Jehan-Francois Paris, University of Houston; and Darrell Long, University of California, Santa Cruz

SESSION 6.3: EESD - END-TO-END QoS PROTOCOLS

6.3.1 EFFICIENT QoS PARTITION AND ROUTING IN MULTISERVICE IP NETWORKS
Irena Atov Hieu Tran and Richard J. Harris, RMIT University

6.3.2 AN EVALUATION OF TIMESTAMP-BASED PACKET SCHEDULERS USING A NOVEL MEASURE OF INSTANTANEOUS FAIRNESS
Hongyuan Shi and Harish Sethu, Drexel University

6.3.3 CLAMP: DIFFERENTIATED CAPACITY ALLOCATION IN ACCESS NETWORKS
Lachlan Andrew, Stephen Hanly and Rami Mukhtar, University of Melbourne

LUNCH: 12:00 - 1:15

SESSION 7: 1:15 - 2:30

SESSION 7.1: SHORT PAPERS I

7.1.1 MULTIFRACTAL ANALYSIS AND MODEL OF THE MPEG-4 VIDEO TRAFFIC
Hong Fei and Wu Zhimei, Chinese Academy of Sciences

7.1.2 EQUATION-BASED APPROACH TO TCP-COMPATIBLE MULTICAST CONGESTION CONTROL FOR LAYERED TRANSMISSION IN LOW-MULTIPLEXING ENVIRONMENTS
Ivica Rimac, Wolfram Liese, Jens Schmitt, and Ralf Steinmetz, Darmstadt University of Technology

7.1.3 USING OPTIMIZATION TO ACHIEVE EFFICIENT QUALITY OF SERVICE IN VOICE OVER IP NETWORKS
Michael Gardner, Federal Aviation Administration; Victor Frost and David Petr, University of Kansas

7.1.4 THE RR/RR CIOQ SWITCH: HARDWARE DESIGN FOR 10-Gbps LINK SPEED
Kenji Yoshigoe and Ken Christensen, University of South Florida; and Aju Jacob, University of Florida

7.1.5 STABILITY OF A MULTICAST TREE IN CUMULATIVE LAYERED MULTICAST CONGESTION CONTROL
Feng Shi, Jianping Wu, and Ke Xu, Tsinghua University

SESSION 7.2: PANEL II: ACADEMIC FREEDOM UNDER FIRE(WALLS) PANEL CHAIR: SHAUN COOPER

SESSION 7.3: EESD - RESOURCE ALLOCATION AND MANAGEMENT

7.3.1 TOWARD END-TO-END FAIRNESS: A FRAMEWORK FOR THE ALLOCATION OF MULTIPLE PRIORITIZED RESOURCES
Yunkai Zhou and Harish Sethu, Drexel University

7.3.2 AN EXPERIMENTAL PROTOTYPE FOR SCALABLE SERVER SELECTION
Mohammed Salem, Jun Chen, Gregor Bochmann and Johnny Wong, University of Montreal

MOHAMMED SALEM, JUN CHEN, GREGOR BOCHMANN AND JOHNNY WONG, UNIVERSITY OF MONTREAL
Michael Katchabaw, Hanan Lutfiyya, Michael Bauer, University of Western Ontario

BREAK: 2:30 - 2:45

SESSION 8: 2:45 - 4:00

SESSION 8.1: SHORT PAPERS II

8.1.1 FUZZY ROUTING IN AD HOC NETWORKS
Gasim Alandjani and Eric Johnson, New Mexico State University

8.1.2 PERFORMANCE EVALUATION OF PREDICTIVE HANDOFF SCHEME WITH CHANNEL BORROWING
Mingyu Wu and Eric Wong, University of Texas at Dallas; and Jenny Li, Avaya Research Labs

8.1.3 USING IEEE 802.11E MAC FOR QoS OVER WIRELESS
Priyank Garg, Rushabh Doshi, Russell Greene, Mary Baker, Majid Malek, and Xiaoyan Cheng, Stanford University

8.1.4 IPSEC OVERHEAD IN WIRELINE AND WIRELESS NETWORKS FOR WEB AND EMAIL APPLICATIONS
George Hadjichristofi, Nathaniel Davis, and Scott Midkiff, Virginia Polytechnic Institute and State University

8.1.5 INTERFERENCE INTERVAL FOR PURGED OBJECTS: A NEW METRIC FOR DESIGN AND ANALYSIS OF WEB CACHING ALGORITHMS
Atsuhiko Tanaka and Kosuke Tatsukawa, NEC Corporation

SESSION 8.2: PANEL III ENABLING UBIQUITOUS MULTI-PLATFORM PROGRAMMING PANEL CHAIR: JURIS REINFELDS

SESSION 8.3: NO SESSION

Please note that the time slots are presently tentative. Tutorials will be canceled if fewer than 8 attendees have registered by 1 April. More Information About These Tutorials Can be Found at www.ipccc.org

IP-ORIENTED QoS IN THE NEXT GENERATION NETWORKS: APPLICATION TO WIRELESS NETWORKS
INSTRUCTOR: PASCAL LORENZ, UNIVERSITE DE HAUTE ALSACE, FRANCE

ABSTRACT: Emerging Internet Quality of Service (QoS) mechanisms are expected to enable wide spread use of real time services for example, VoIP and videoconferencing. The "best effort" Internet delivery cannot be used for the new multimedia applications. New technologies and new standards are necessary to offer Quality of Service (QoS) for these multimedia applications. Therefore new communication architectures integrate mechanisms allowing to guarantee QoS services as well as high rate for the communications.

The promising service level agreement to a mobile Internet user is hard to come by, since there may not be enough resources available in some parts of the IP/ATM networks as mobile terminal is moving into. The emerging QoS architectures, differentiated services and integrated services do not consider the network nodes are mobile. QoS mechanisms enforce a differentiated sharing of bandwidth among services and users. Thus, there must be mechanisms available to identify traffic flows with different QoS parameters, and to make it possible to charge the users based on requested quality. Integration of fixed and portable wireless access into IP networks presents a cost effective and efficient way to provide seamless end-to-end connectivity and ubiquitous access in a market where demands on mobile Internet have grown rapidly and predicted to generate billions of dollars in revenue.

The tutorial covers an introduction to QoS in heterogeneous networks, Internet delivery over future wireless networks, the ATM, MPLS, DiffServ, IntServ protocols. It addresses characteristics of the Internet and its mobility features and how it could guarantee QoS using wireless IP services. It also presents concepts of routing, quality-of-service provisioning and security, baseline architecture of the inter-networking protocols and end to end traffic management issues.

Biography: Pascal Lorenz [SM '00] (lorenz@ieee.org) received his PhD from the University of Nancy, France. Between 1990 and 1995 he was research engineer at WorldFIP Europe and at Alcatel-Alsthom. He is professor at the University of Haute-Alsace and responsible of the Network and Telecommunication Research Group. His research interests include QoS, wireless networks and high-speed networks. He was the Program and Organizing Chair of the IEEE ICATM'98, ICATM'99, ECUMN'00, ICN'01, ECUMN'02 conferences. Since 2000, he is Technical Editor of the IEEE Communications Magazine Editorial Board. He is the secretary of IEEE ComSoc Communications Systems Integration and Modeling Technical Committee. He is a member of many international committees programs and he has served as a guest editor for a number of special issues, including Telecommunication System, IEEE Communications Magazine and LNCS. He is member of many conferences technical program committees, he has organized and chaired several technical sessions. He has given tutorials in major international conferences. He is the author of 2 books and 90 international publications in journals and conferences.

PERVCOMP: A NEW COMPUTING PARADIGM FOR THE 21ST CENTURY

INSTRUCTORS: DEBASHIS SAHA, MIS GROUP, IIM CALCUTTA
AMITAVA MUKHERJEE, SC OF CSE, UNSW, SYDNEY, AUSTRALIA

Abstract: Pervasive Computing (PervComp) is "omni-computing". It is "all-pervasive" by combining open standards-based applications with everyday activities. In the vision of PervComp, the environment is saturated with a host of computing

and communication capabilities which are gracefully integrated with daily life so that user will be able to exchange information and control their environments from everywhere using a seemingly invisible infrastructure of various wireline and/or wireless networks and computing devices. It removes the complexity of new technologies, enables us to be more efficient in our work and leaves us with more leisure time. Thus, PervComp is about four things: users, applications, middlewares, and networks. First, it concerns the way people view mobile/static computing and/or communication devices, and use them within their environments to perform tasks. Second, it concerns the way applications are created and deployed to enable such tasks to be performed. Third, it concerns the environment, which comprises interface between the applications and the network. Fourth, it concerns the underlying network that supports pervasiveness. In this tutorial, we sketch the evolutionary path for this new paradigm of computing, discuss its nature and infrastructural properties, and suggest requirements that this infrastructure must meet to become a "technology that disappears", vis-a-vis the shortcomings of the currently existing architectures. While doing so, this tutorial also describes the current research initiatives on PervComp, highlighting some common requirements for the intelligent environment that PervComp demands.

Biographies:

Debashis Saha is an Associate Professor in the MIS & Computer Science group of Indian Institute of Management (IIM) Calcutta. He received his B.E. degree in Electronics & Telecommunication Engg. from Jadavpur University, Calcutta, India, in 1986, and his M. Tech. and Ph. D. degrees, both in Electronics & Electrical Communication Engg., from the Indian Institute of Technology (IIT) at Kharagpur, India, in 1987 and 1995, respectively. He was a senior research scholar at IIT, Kharagpur between 1988 and 1990 while conducting research on protocol engineering. He was with Jadavpur University as a faculty member in the Computer Science & Engg Department from 1990 to 2001. His research areas are: Network protocols, WDM optical networks, Wireless Networking & Mobile Computing, and Pervasive Communication & Computing. He has published more than hundred papers in various conferences and journals and delivered several invited talks and tutorials in networking conferences/workshops. He is currently the principal investigator of two major govt. funded projects on WDM Optical Networking Research Initiatives. He has co-authored four books and a monograph. His most recent co-authored book is on Networking Infrastructure for Pervasive Computing published by Kluwer Academic Publishers, Boston USA. Dr. Saha is a life-member of Computer Society of India (CSI), a member of IFIP WG 6.8 and 6.10, a Senior Member of IEEE, and a member of IEEE Computer Society and IEEE Communication Society. He is a recipient of the prestigious Career Award for Young Teachers (1997) from the All India Council for Technical Education (AICTE), Govt. of India, and is a SERC Visiting Fellow (1999) and a BOYSCAST Fellow (2000) of Dept. of Science & Technology (DST), Govt. of India.

Amitava Mukherjee is currently visiting University of New South Wales (UNSW) at Sydney in Australia from Jan 2003. He received his Ph.D. degree in Computer Science from Jadavpur University, Calcutta, India. Since June 1995, he is a Principal Consultant in erstwhile PwCC India, which is now IBM Business Consulting Services, part of IBM Global Services India from Oct 2002. He was in the Department of Electronics and Telecommunication Engineering at Jadavpur University, Calcutta, India from 1983 to 1995. His research interests are in the areas of Mobile Computing and Communication, Pervasive Computing and Mobile Commerce, Optical

Networks, Combinatorial Optimization and Distributed Systems. His interests also include the Mathematical Modeling and its applications in the fields of Societal Engineering and International Relations. He has delivered several tutorials and invited talks in both industry and academia. He is the author of over 75 technical papers, one monograph and four books. His most recent co-authored book is on Networking Infrastructure for Pervasive Computing published by Kluwer Academic Publishers, Boston USA. He is a member of IEEE, IEEE Communication Society.

JAVA APPLICATIONS AND SECURITY

INSTRUCTOR: DR. SUB RAMAKRISHNAN

ABSTRACT: Java was introduced as an OOP language less than a decade ago. It is already becoming the preferred language of choice for e-commerce and database applications. However, there are two important aspects of Java that are less well understood, namely, (1) Java Applications and Security and (2) E-commerce and Java Cryptography. We believe these two issues have significant relevance to the design and deployment of secure database (stand-alone or web enabled) applications for e-commerce. This half-day tutorial will be devoted to the first topic. We expect to address the second topic in a separate half-day tutorial at this conference.

Java Applications and Security: The security features (or lack) of Java have been examined more than any other language. Contrary to popular belief, the security features of Java applications and applets are at two extremes; applets use a sandbox model and enforce tight security, while applications run outside of the sandbox and enforce no security at all. In practice, there is a need to understand and possibly alter these security configurations; for example, it is desirable to allow an applet loaded from foo.com to make a socket connection to database.com yet deny this privilege to an applet loaded from elsewhere. This tutorial provides an overview and classification of a number of security issues of applets and applications. Occasionally, we use database access programs as examples in illustrating Java security considerations. To the extent possible, we will use code examples to demonstrate our ideas and show how the code can be reused/incorporated in user-written applications and or applets. In addition, we will discuss the security configurations for the two popular web browsers, Netscape and IE.

Biography: Please see the following Tutorial

E-COMMERCE AND JAVA CRYPTOGRAPHY

INSTRUCTOR: SUB RAMAKRISHNAN
BOWLING GREEN STATE UNIVERSITY

Java was introduced as an OOP language less than a decade ago. It is already becoming the preferred language of choice for e-commerce and database applications. However, there are two important aspects of Java that are less well understood, namely, (1) Java Applications and Security and (2) E-commerce and Java Cryptography. We believe these two issues have significant relevance to the design and deployment of secure database (stand-alone or web enabled) applications for e-commerce. This half-day tutorial will be devoted to the second topic. We expect to address the first topic in a separate half-day tutorial at this conference.

E-commerce and Java Cryptography: The cryptographic capabilities of Java make it an attractive vehicle for building e-commerce applications. For example, one may be interested in the secure transport of database query results between applications. The Java Cryptographic Extension (JCE) promises plug-in cryptographic libraries and seamless addition of a number of security components and services such as message digests, digital signatures, random number generators and algorithms for symmetric and public key cryptography. This

tutorial provides an overview of the Java cryptographic libraries and examines the components that are required to build secure application systems using the Java framework. In some instances, we will use database access examples in our illustration of adding cryptographic components. We will describe actual cryptographic mechanisms and how to implement some of these components in e-commerce applications, using the Java Cryptographic Architecture.

In addition, we will discuss the Java Secure Socket Extension (JSSE) framework. JSSE provides a security layer (SSL) extension to the standard socket paradigm. While SSL is widely used over the web, non-web client server applications using these features are less well understood.

Biography: Dr. Sub Ramakrishnan is a Professor of Computer Science at Bowling Green State University, Bowling Green, OH, USA. His applied computer science interests include computer security and web-to-database connectivity, three-tier architectures and secure internet technologies, and data warehousing.

Dr. Ramakrishnan's work on distributed systems was supported by the National Science Foundation. He has published widely in the area of distributed systems and complexity of algorithms. He has had consulting opportunities on E-commerce solutions.

NETWORK AWARENESS FOR HETEROGENEOUS DATA NETWORKS

INSTRUCTOR: LIANG CHENG
LEHIGH UNIVERSITY

Abstract: Network awareness, which is defined as the capability of network devices and applications to be aware of network characteristics, is the basis for network quality-of-service (QoS) provisions and network management.

Data networks today, in general, are heterogeneous. Advances in data networking, wireless communications, and digital-system miniaturization add new heterogeneities into existing data networks.

The necessity of network awareness in heterogeneous data networks will be illustrated by several experimental studies, such as multimedia collaboration, QoS provision, and cluster computing in heterogeneous data networks. Existing techniques of network awareness will be studied in four research areas: link-type awareness, link-bandwidth awareness, service awareness, and network awareness service framework.

Link-type awareness in this tutorial refers to the detection of the existence of wireless links along an end-to-end communication path. Implicit methods, such as what have been used in wireless TCP, and explicit methods, such as API and SNMP approaches, will be illustrated. Also cutting-edge studies, such as fuzzy reasoning for wireless awareness, will be presented.

Link-bandwidth awareness techniques will be investigated in three categories based on three different models: one-packet model, packet-pair model, and multi-packet model. Their performance in terms of accuracy, intrusiveness to the network, and efficiency will be studied in various heterogeneous data networking scenarios, such as ADSL networks.

Service awareness mechanisms including Jini and SLP (Service Location Protocol) for service advertisement and discovery in heterogeneous data networks will be studied. Specifically, a lightweight service awareness mechanism will be presented in the context of mobile ad hoc networks.

The above network awareness techniques could be implemented as services for network devices and applications. Thus we will also study existing frameworks that integrate these services together to provide network awareness service. Network awareness service framework for adaptive mobile applications in the Odyssey project will be illustrated. Also researches on architecture for exporting environment awareness to mobile computing applications and for developing network-aware applica-

tions will be presented.

Beside the above-mentioned unitary framework for network awareness service, piecewise framework for efficient integration of various network awareness techniques in heterogeneous data networks will be presented. Analytical results on the performance of these frameworks will be studied in terms of wireless bandwidth and battery energy consumption.

Biography: Liang Cheng is an Assistant Professor of Computer Science and Engineering Department at Lehigh University. He was formerly a research scientist at Rutgers Center for Advanced Information Processing, Piscataway, New Jersey. He received the Ph.D. degree from Rutgers, The State University of New Jersey, in 2002. He has four journal and ten conference publications in the areas of network awareness and network performance measurement.

WIRELESS SENSOR NETWORK PROTOCOLS

INSTRUCTOR: KRISHNA SIVALINGAM, PH.D.,
ASSOCIATE PROFESSOR DEPARTMENT OF COMPUTER SCIENCE AND ELECTRICAL ENGINEERING, UNIVERSITY OF MARYLAND

Abstract: Tremendous technological advances have been made in the development of low-cost sensor devices equipped with wireless network interfaces. The sensors monitor various types of information such as temperature, pressure, chemicals, etc. and/or transmit voice and video data. The design of large-scale sensor networks interconnecting several hundred to a few thousand sensor nodes has attracted recent research attention. Such sensor networks may be used for applications spanning several domains including military, medical, industrial, and home networks. The purpose of the tutorial is to present a comprehensive introduction to wireless sensor networks - basic concepts, challenges, recent research, and further possibilities. The topics covered will be based on fundamental concepts and up-to-date material in the literature, as listed below: Introduction to wireless sensor networks, and evolution of protocols for sensor networks.

- Data dissemination and aggregation
- Routing Protocols
- Multiple Access Protocols
- Energy-efficient protocol design
- Localization
- Exposure and Coverage problems
- Security
- Testbeds and application scenarios
- Summary

Biography: Prof. Krishna M. Sivalingam (IEEE Senior Member) is an Associate Professor in the Dept. of CSEE at University of Maryland, Baltimore County. Previously, he was with the School of EECs at Washington State University, Pullman from 1997 until 2002; and with the University of North Carolina Greensboro from 1994 until 1997. He has conducted research at Lucent Technologies' Bell Labs in Murray Hill, NJ, and at AT&T Labs in Whippany, NJ. He received his Ph.D. and M.S. degrees in Computer Science from State University of New York at Buffalo in 1994 and 1990 respectively; and his B.E. degree in Computer Science and Engineering in 1988 from Anna University, Chennai (Madras), India. While at SUNY Buffalo, he was a Presidential Fellow from 1988 to 1991. His research interests include wireless networks, optical wavelength division multiplexed networks, and performance evaluation. He is serving as Guest Co-Editor for a special issue of ACM MONET on "Wireless Sensor Networks" and in an issue of SPIE Optical Networks Magazine on "Recent Advances in Optical Networking", and in the past has served as a Guest Co-Editor for a special issue of the IEEE Journal on Selected Areas in Communications on optical WDM networks. He is a member of the Editorial Board for KICS Journal of Computer Networks. He is presently serving as General Co-Chair for Opticomm 2003 (Dallas, TX) and as a Steering Committee Member of ACM Intl. Workshop on Wireless Sensor

Networks and Applications (WSNA). Recently, he served as Technical Program Co-Chair of SPIE/IEEE/ACM OptiComm conference at Boston, MA in July 2002; and as Workshop Co-Chair for WSNA 2002 held in conjunction with ACM MobiCom 2002 at Atlanta, GA in Sep 2002.

ASAP: ASSURING SCALABILITY FOR APPLICATION PERFORMANCE

INSTRUCTOR: NEIL J. GUNTHER
PERFORMANCE DYNAMICS CO.

Abstract: Application scalability is key to success for most organizations. Hardware has become relatively cheap and fast. Distributed applications are the new and more complex performance determinant. Developers and QA testers use tools, such as Mercury-Interactive's LoadRunner(tm) and Microsoft's WAS (Web Application Stress), to predict the scalability of application functions under virtual user loading.

Under the pressure of shortened development schedules that typify the modern business environment, the focus tends to be on functionality first. New functionality, however, is often overprescribed because it is perceived by the organization as a competitive differentiator. As a consequence, most of the development time tends to be absorbed by measuring user requirements (functional testing) and the maximum number of users that can be supported (stress testing). Unfortunately, when finally deployed, the new application often fails to meet performance expectations.

The question naturally arises, Can we do better and can we do it quickly (ASAP)? That's the subject of this half-day tutorial.

The question will be answered in the affirmative by examining the following points (among others):

- How many load points should you measure?
- How do you know you have a consistent set of measurement data?
- What additional performance data should you collect?
- What timing wrappers are needed to measure scalability?
- Queueing models are limited. Is there a better way?
- I'll show you how all this can be done in an EXCEL spreadsheet.
- Several case studies showing both good and bad analysis.

I've used this technique, which is based partly on Chapter 6 of my book: THE PRACTICAL PERFORMANCE ANALYST (iUniverse 2001), successfully for a decade. My approach can also reduce the overall cost of benchmarking applications prior to deployment. The presentation will be advanced tutorial in style with no background in performance analysis or capacity planning assumed.

Biography: Neil J. Gunther, M.Sc., Ph.D. is a leading industry computer performance consultant who founded Performance Dynamics Company (www.perfdynamics.com) in 1994. Prior to that, Dr. Gunther held research and management positions at San Jose State University, JPL/NASA (Voyager and Galileo spacecraft), Xerox PARC research center and Pyramid/Siemens Technology. His performance and capacity planning classes have been presented at such organizations as Boeing, Fedex, Motorola, Stanford University, and Sun Microsystems.

Dr. Gunther is the author of over a hundred papers on computer performance topics, including "HIT-AND-RUN TACTICS ENABLE GUERRILLA CAPACITY PLANNING," published recently in IEEE IT Professional. He has also written the book THE PRACTICAL PERFORMANCE ANALYST (iUniverse.com 2000). In 1996 he was awarded Best Technical Paper at CMG, and in 1997 was nominated for the A.A. Michelson Award. Dr. Gunther is a member of the AMS, ACM, CMG, IEEE, SAGE-AU, SIGMETRICS and USENIX.

IPCCC 2003 Registration Form

Register on the Web at <http://www.ipccc.org/>

<hr/> Last Name	<hr/> First Name	<hr/> Middle Initial	<p>Mail completed form with check or fax with complete credit card information to:</p> <p>Dr. Brian Grayson 7700 West Parmer Lane MD: PL30 Austin, TX 78729 Tel: (512) 996-4956 Fax: (512) 996-7439</p> <p>Email: Brian.Grayson@motorola.com</p>
<hr/> Job Title	<hr/> Organization or Affiliation (University and Student ID)		
<hr/> Address			
<hr/> City	<hr/> State (Province, Country)	<hr/> Zip Code	
<hr/> Phone	<hr/> Fax Number		
<hr/> Title and Name for Badge			
<hr/> E-mail Address	<hr/> IEEE Member Number		

Group Discount: Discounts are available for group registration. To be eligible, all registrations for the group must be included at the same time with the fax being sent for all in the group at once (or sent in one envelope by mail). Groups of 5 to 9 receive a 5% discount; groups of 10 or more receive a 10% discount. See the payment information below.

Fees (US Dollars)	Technical Session only	Tutorials only	Tutorials and Technical Session	Tutorial Choices
IEEE Members	\$475	\$180	\$655	If you are registering for tutorials, please indicate your morning and afternoon choices here. For descriptions of the tutorials, you may consult the IPCCC web page at: http://www.ipccc.org/ Morning half-day Tutorial choices _____ Afternoon half-day Tutorial choices _____
non-Members	\$600	\$225	\$825	
Students	\$150	\$40	\$190	
<p>*A full-day of tutorials is composed of two half-day tutorials, breakfast, lunch and copy of handouts. • Technical registration includes 2 breakfasts, 2 lunches, 1 proceedings and reception. • Tutorial registration includes 1 breakfast, 1 lunch and 1 copy of handouts. • Student registration does not include the proceedings. An extra set of proceedings is \$25.00.</p>				

Payment Information			
Conference Fee	\$ _____	_____ Check or Money Order	Card Number _____
		payable to IPCCC 2003 Registration	Expiration Date _____
Less Group Discount	_____	_____ American Express	Cardholder's Name _____
		_____ Mastercard	Signature _____
Total Due	\$ _____	_____ VISA	Date _____
<p>Please fax your payment authorization, along with the credit card information form. No wire transfers or invoices will be accepted. Each attendee must use a separate registration form. Registrants not using a credit card must include a check or money order payable to IPCCC 2003 and drawn on a U.S. bank, or a U.S. branch of a foreign bank for the total amount in US\$. Group discounts: Discounts are available for group registration. To be eligible, all registration forms for the group must be received in the same fax or same envelope by mail. Groups of 5 to 9 receive a 5% discount; groups of 10 or more receive a 10% discount.</p>			

Conference Site

The conference site will be:

Embassy Suites Phoenix North
 2577 West Greenway Rd
 Phoenix, AZ 85023-4222
 Telephone for reservations: (800) 527-7715
 Other phone: (602) 375-1777

To guarantee these rates, request "IEEE IPCCC" reservation rates when making your reservation. Free cooked breakfast is included for each occupant. More details about the hotel can be found at: www.embassy-suites.com/en/es/hotels/index.jhtml?ctyhocn=PHXNOES

Embassy Suites Rates are:

- Single/Double occupancy (King bed or two double beds)
- \$129+12.07% tax per night
- Triple/Quad occupancy
- \$139+12.07% tax per night